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country, of pursuing an inquiry of deep historical interest; which if they were to occur at the other side of the Irish channel, would be grasped at with avidity by the untiring zeal of many an English antiquary, who, while he cultivates assiduously, and under circumstances of extreme difficulty, the meagre opportunities which England affords to the study of ancient *British* and Celtic remains, cannot but look with a feeling of astonishment (akin perhaps to contempt), on the apathy with which in Ireland we suffer daily the tangible and unquestionable proofs of the early civilization of our country, to which we have long proudly laid claim, actually to perish before our eyes, from the most disgraceful negligence.

The Chair having been taken, *pro tempore*, by the Rev. J. H. Todd, D. D., V. P., the President communicated the following proof of the known law of Composition of Forces.

Two rectangular forces, x and y , being supposed to be equivalent to a single resultant force p , inclined at an angle v to the force x , it is required to determine the law of the dependence of this angle on the ratio of the two component forces x and y .

Denoting by p' any other single force, intermediate between x and y , and inclined to x at an angle v' , which we shall suppose to be greater than v ; and denoting by x' and y' the rectangular components of this new force p' , in the directions of x and y , we may, by easy decompositions and recompositions, obtain a new pair of rectangular forces, x'' and y'' , which are together equivalent to p' , and have for components

$$x'' = \frac{x}{p} x' + \frac{y}{p} y';$$

$$y'' = \frac{x}{p} y' - \frac{y}{p} x';$$

the direction of x'' coinciding with that of p' , but the direction of y'' being perpendicular thereto. Hence,

$$\frac{y''}{x''} = \frac{xy' - yx'}{xx' + yy'};$$

that is,

$$\tan^{-1} \frac{y''}{x''} = \tan^{-1} \frac{y'}{x'} - \tan^{-1} \frac{y}{x};$$

or, finally,

$$f(v' - v) = f(v') - f(v), \quad (\text{A})$$

at least for values of v, v' , and $v' - v$, which are each greater than 0, and less than $\frac{\pi}{2}$; if f be a function so chosen that the equation

$$\frac{y}{x} = \tan f(v)$$

expresses the sought law of connexion between the ratio $\frac{y}{x}$ and the angle v . The functional equation (A) gives

$$f(mv) = mf(v) = \frac{m}{n}f(nv),$$

m and n being any whole numbers; and the case of equal components gives evidently

$$f\left(\frac{\pi}{4}\right) = \frac{\pi}{4};$$

hence

$$f\left(\frac{m}{n} \frac{\pi}{4}\right) = \frac{m}{n} \frac{\pi}{4},$$

and ultimately,

$$f(v) = v, \quad (\text{B})$$

because it is evident, by the nature of the question, that while v increases from 0 to $\frac{\pi}{2}$, the function $f(v)$ increases therewith, and therefore could not be equal thereto for all values of v commensurable with $\frac{\pi}{4}$, unless it had the same property also for all intermediate incommensurable values. We find, therefore, that for all values of the component forces x and y , the equation

$$\frac{y}{x} = \tan v \quad (c)$$

holds good; that is, the resultant force coincides *in direction* with the diagonal of the rectangle constructed with lines representing x and y as sides.

The other part of the known law of the composition of forces, namely, that this resultant is represented also *in magnitude* by the same diagonal, may easily be proved by the process of the *Mécanique Céleste*, which, in the present notation, corresponds to making

$$x' = x, \quad y' = y, \quad x'' = p,$$

and therefore gives

$$p = \frac{x^2 + y^2}{p}, \quad p^2 = x^2 + y^2.$$

But the demonstration above assigned for the law of the *direction* of the resultant, appears to Sir William Hamilton to be new.

It was resolved, on the recommendation of the Council, to present a congratulatory address to His Excellency the Lord Lieutenant; whereupon, the Academy having adjourned for a short interval, an address was prepared, which was afterwards agreed to.

A letter was read from M. Moreau de Jonnés, presenting to the Academy two volumes of the *Agricultural Statistics of France*.

DONATIONS.

Comptes Rendus Hebdomadaires des Seances de l'Académie des Sciences. Premier Semestre. 1841. Nos. 17-24.

Ordnance Map of the Queen's County, in 39 sheets, including Title and Index. Presented by His Excellency the Lord Lieutenant.

Journal of the Franklin Institute. Vol. I. Third Series. (1841).